

Experiences with Industrial Solar Process Steam Generation in Jordan

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Knowledge for Tomorrow



Solar Field at RAMPharma, Amman

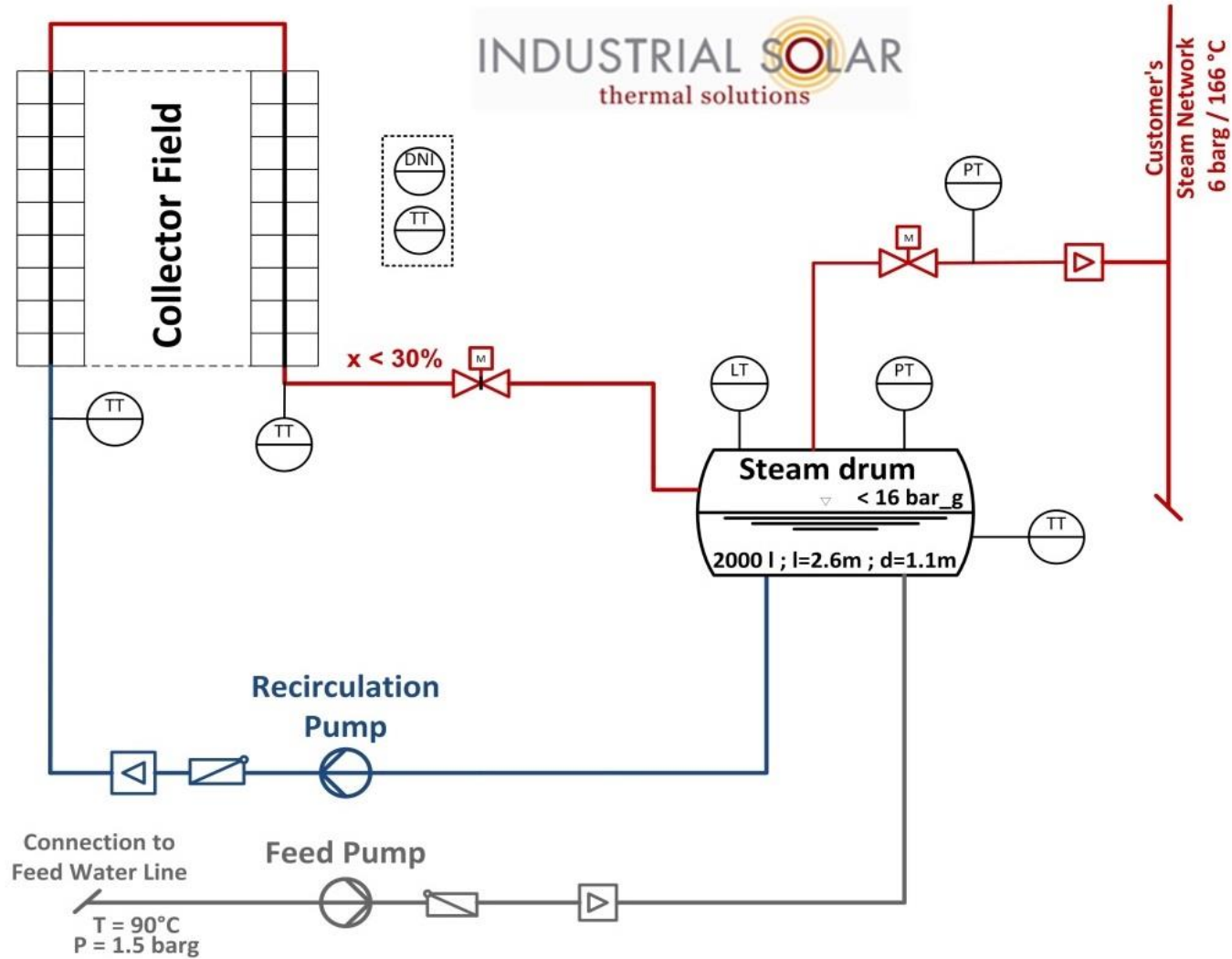
- Solar field: linear Fresnel collectors of Industrial Solar GmbH
- Supply of saturated steam at 6 bar gauge
- Start of operation: March 2015



Collector field and steam drum with piping to steam network



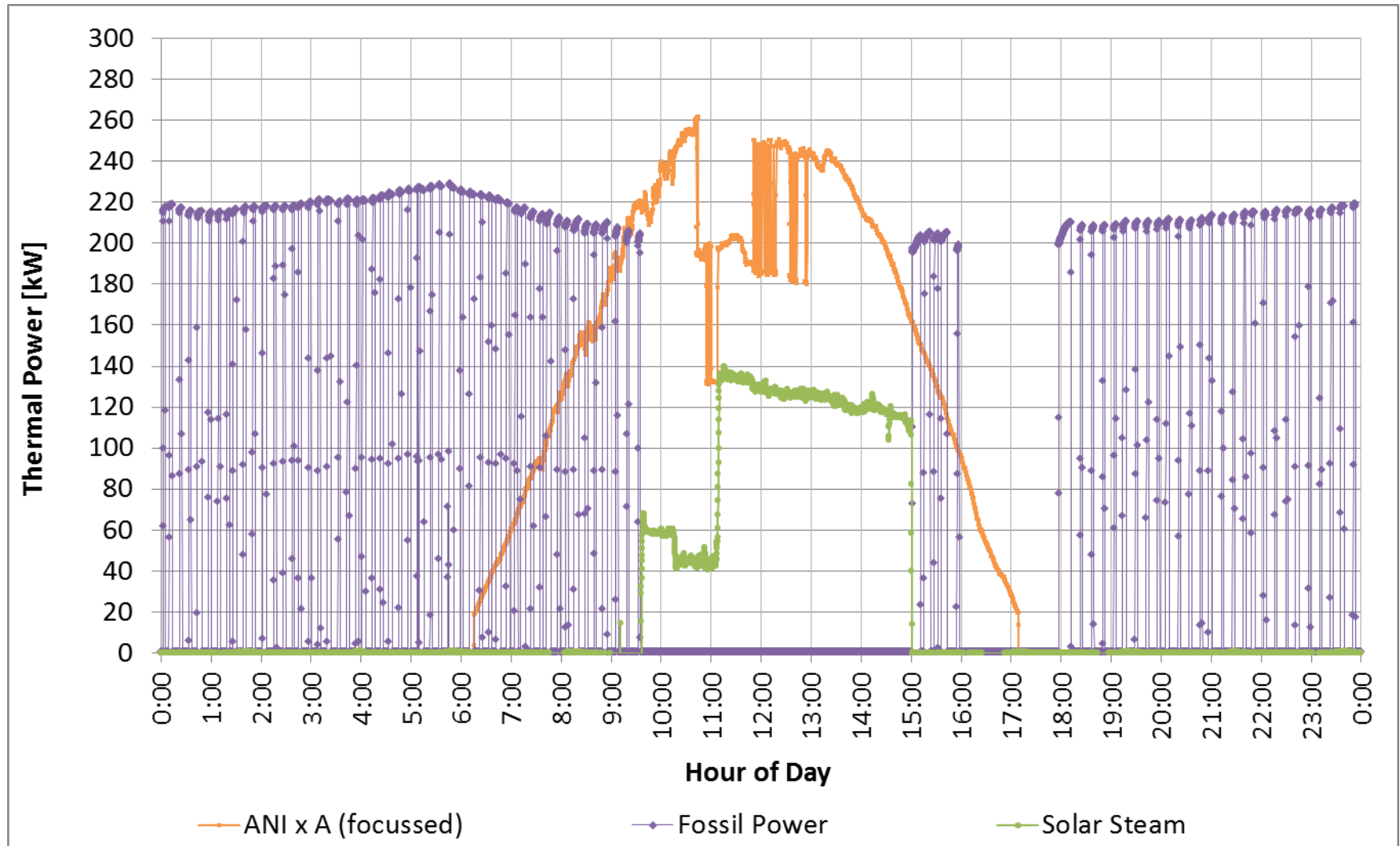
Solar Field at RAMPharma, Amman



General design, SD only



Experience of Operation with SD



7th of April 2015



INDUSTRIAL SOLAR
renewables onsite

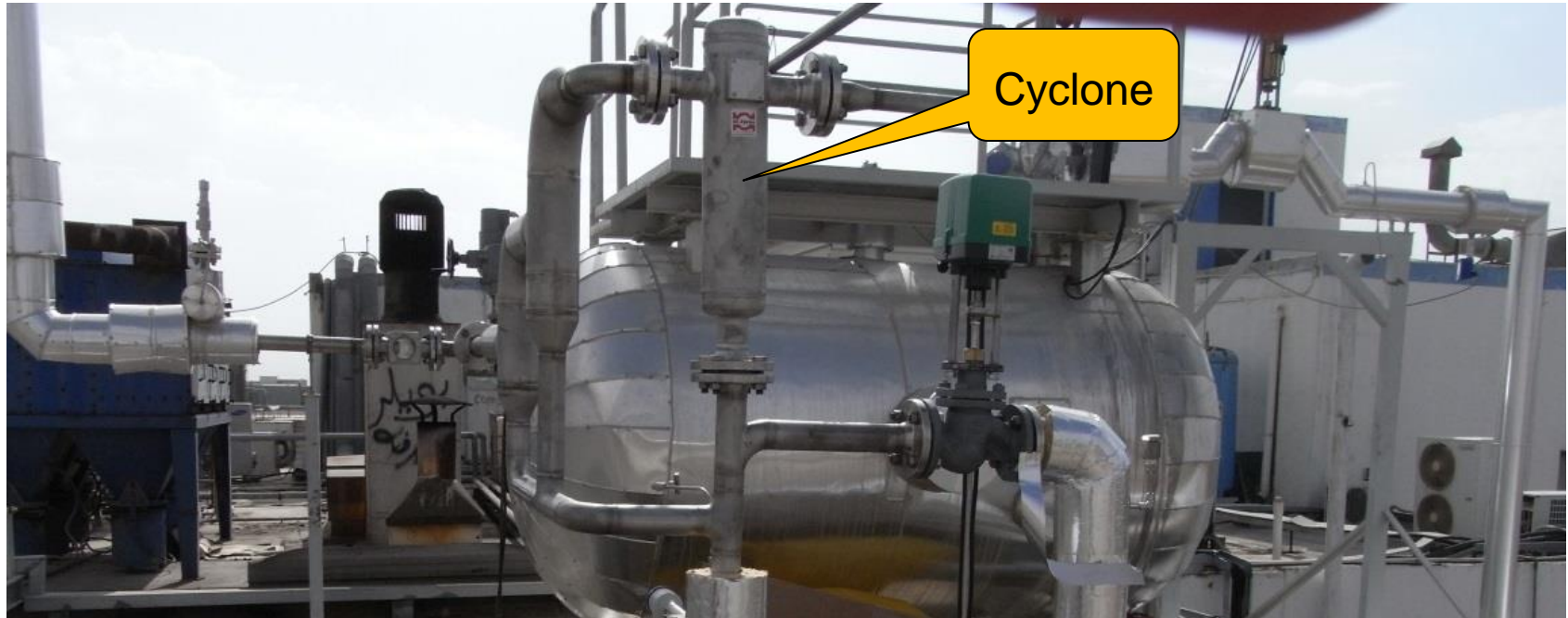


Experience of Operation with SD

- Reliable operation
- No negative interference with conventional steam supply
- Solar steam supply often higher than demand
- SD function as Ruth storage works well by supplying steam in a pressure range from 7 bar_g to 14 bar_g
- High concentration of minerals in steam drum
=> need for blow down more often
- High pH values can damage components
=> choose accordingly



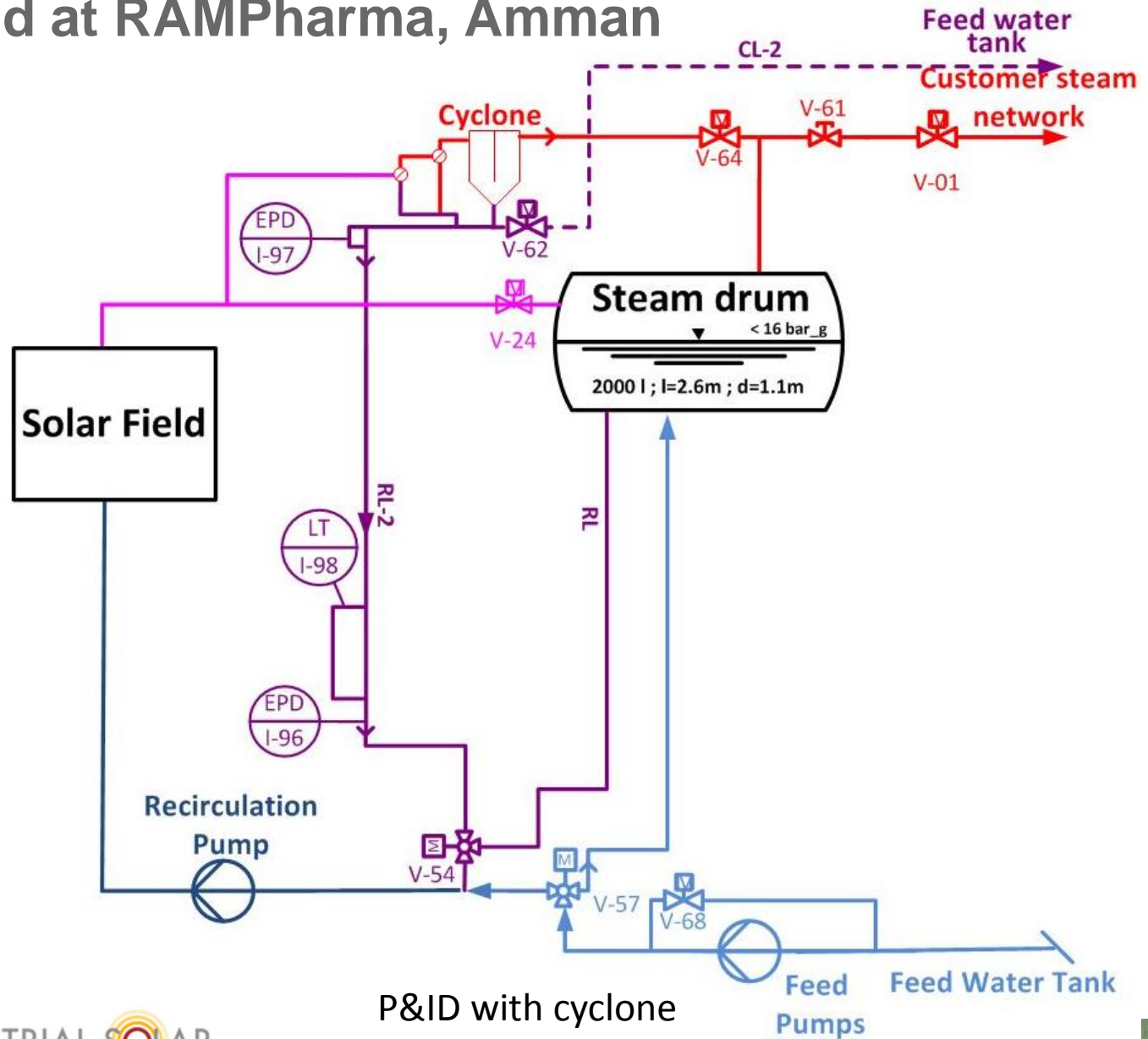
Cyclone at RAMPharma, Amman



- SolSteam project: test of alternative separator
- Motivation: save investment costs



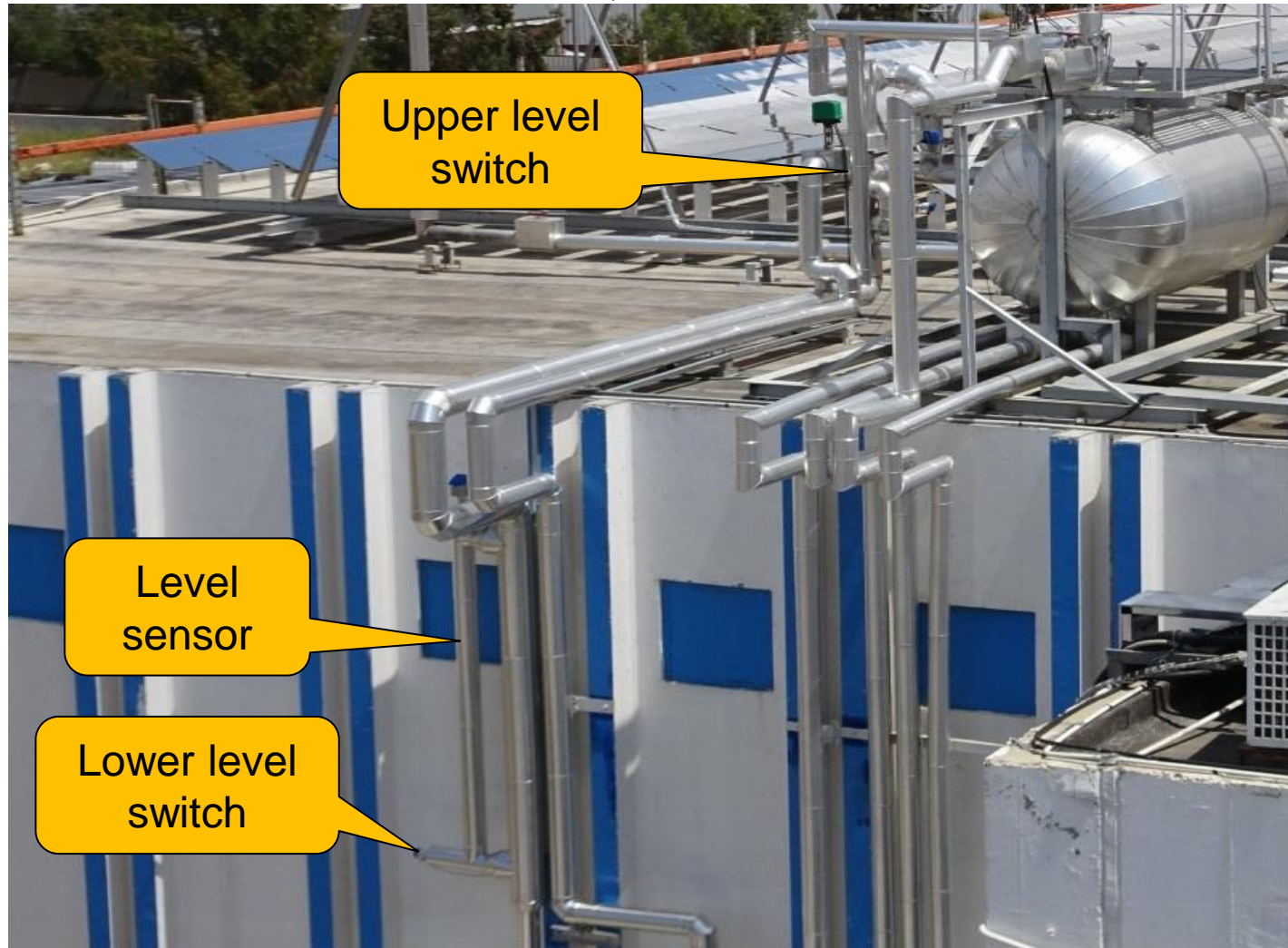
Solar Field at RAMPharma, Amman



P&ID with cyclone



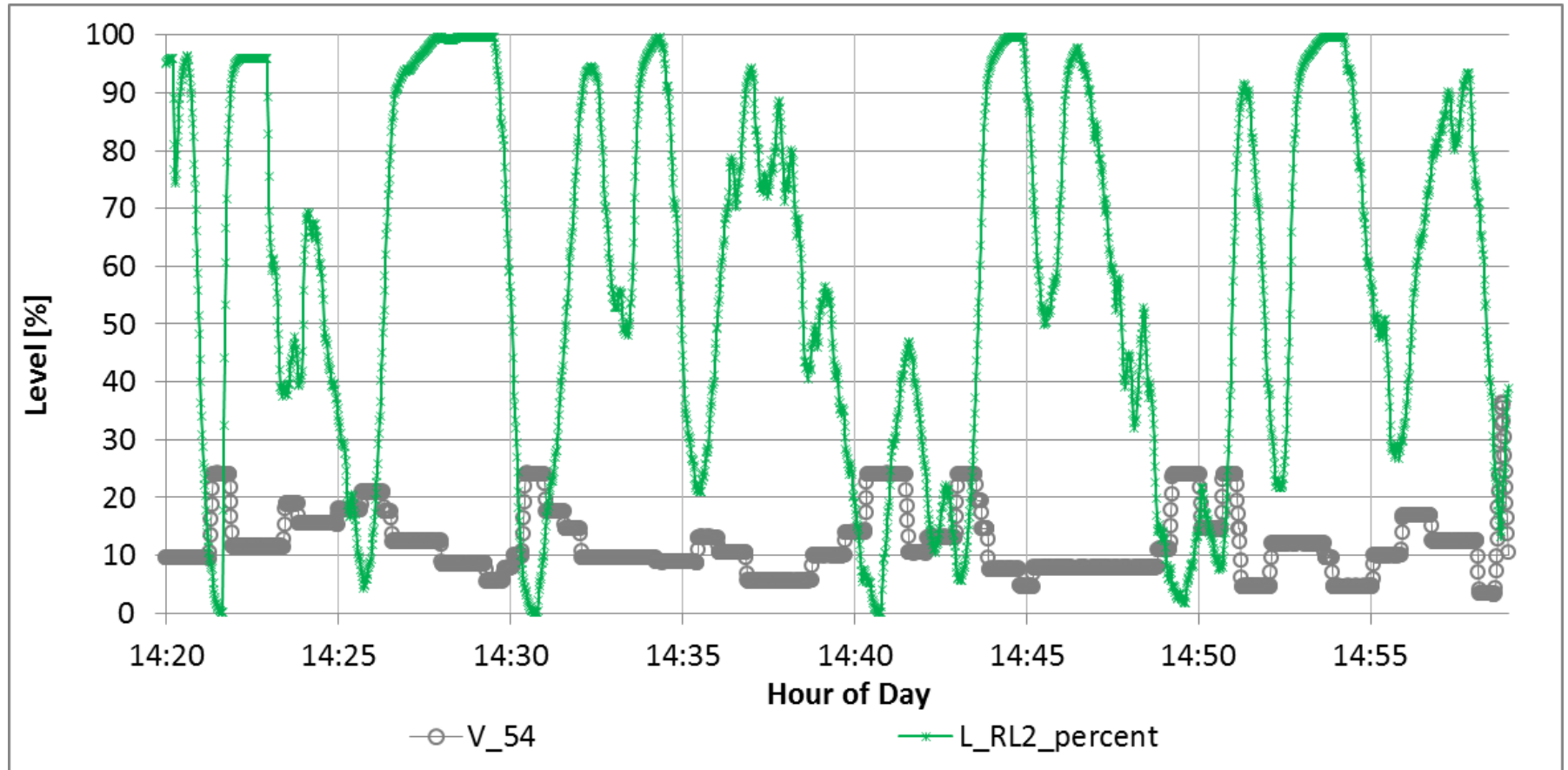
Solar field at RAMPharma, Amman



Instrumentation to control the water level in the piping below the cyclone



Solar field at RAMPharma, Amman



Manual control of condensate level during cyclone operation



Conclusions

Operation along steam drum:

- Works well
- Stabilizes operation
 - Solar steam supply constant even at strong variations in demand

Operation along cyclone:

- Manual control works
- Automatic control will be implemented
- Fast control needed

